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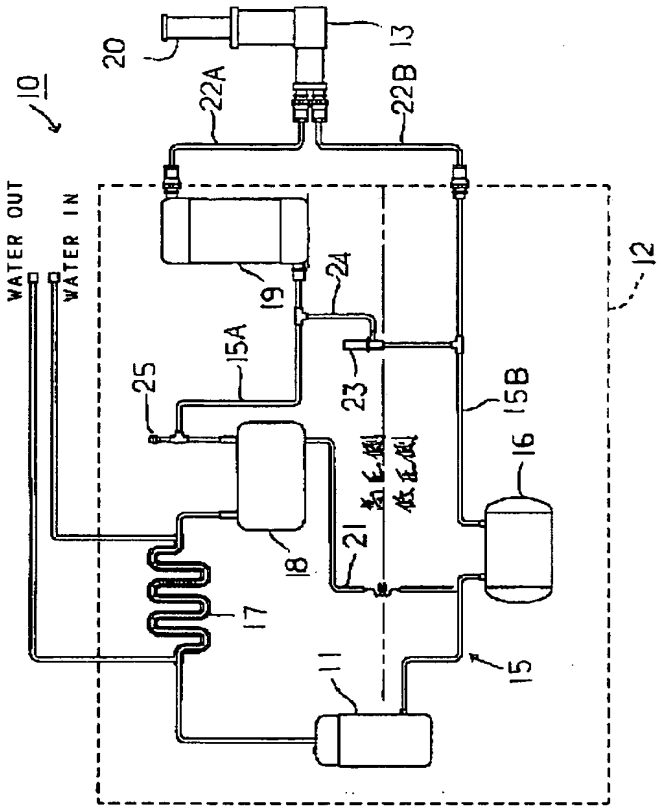
TITLE : VERY LOW TEMPERATURE REFRIGERATING DEVICE



ABSTRACT : PROBLEM TO BE SOLVED: To secure a flow rate of a refrigerant, supplied from a compression unit to a refrigerator, throughout a wide range.

SOLUTION: A very low temperature refrigerating device 10 comprises a compression unit 12 having a compressor 11 to pressurize a refrigerant through compression, and a refrigerator 13 to realize a very low temperature by a pressurized refrigerant fed from the compression unit. In the device, a route 15A on the high pressure side and a route 15B on the low pressure side of the compression unit are intercoupled through a main bypass piping 24 having a main pressure regulating valve 23. The main pressure regulating valve is opened when a pressure in the route on the low pressure side is reduced to a value lower than a given pressure, and formed in a manner to cause bypass of a refrigerant from the route on the high pressure side to the route on the low pressure side.

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CLAIMS

[Claim(s)]
[Claim 1] In the very-low-temperature freezer which has the compression unit equipped with the compressor which compresses and pressurizes a refrigerant, and the refrigerator which realizes very low temperature with the pressurization refrigerant from this compression unit The high-tension-side path and low-tension side path of the above-mentioned compressor unit are connected by the bypass path equipped with the pressure regulating valve. The above-mentioned pressure regulating valve The very-low-temperature freezer characterized by having opened when the pressure of a low-tension side path became below the predetermined pressure A, and being constituted so that a refrigerant may be bypassed from the above-mentioned high-tension-side path to the above-mentioned low-tension side path.
[Claim 2] The pressure sensor which detects the pressure of this high-tension-side path is installed in the high-tension-side path of the above-mentioned compression unit. The above-mentioned high-tension-side path and a low-tension side path are connected in the subbypass path equipped with the closing motion valve. Moreover, the above-mentioned closing motion valve The very-low-temperature freezer according to claim 1 characterized by having opened when the pressure detected with the above-mentioned pressure sensor turned into more than the predetermined pressure B, and being constituted so that the refrigerant of the above-mentioned high-tension-side path may be bypassed to the above-mentioned low-tension side path.
[Claim 3] It is the very-low-temperature freezer according to claim 1 characterized by being constituted so that the high-tension-side path and low-tension side path in the above-mentioned compression unit are connected in the subbypass path equipped with the sub pressure regulating valve, and the above-mentioned sub pressure regulating valve may open when the pressure of the above-mentioned high-tension-side path turns into more than the predetermined pressure B, and it may bypass the refrigerant of the above-mentioned high-tension-side path to the above-mentioned low-tension side path.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the very-low-temperature freezer used for a cooling system or cryopump for condensing the cooling system of cooling systems, such as a superconduction magnet and a semiconductor device, and the physical-properties test equipment in very low temperature, and liquid helium etc.
[0002]
[Description of the Prior Art] A very-low-temperature freezer is used for the cryopump which condenses or adsorbs a gas molecule at the panel cooled by very low temperature, and is made to generate high vaccum pressure, a panel is cooled to very low temperature (for example, 10-20K) as mentioned above, or it is used for cooling systems, such as a superconduction magnet and physical-properties test equipment, and makes a superconduction magnet and a sample cool to very low temperature (for example, 4K) generally.
[0003] The compression unit 103 and a refrigerator 104 equipped with the compressor 102 are connected for the connection piping 105A and 105B, and such a very-low-temperature freezer 101 is constituted, as shown in drawing 5 . A heat exchanger 106 is arranged in the refrigerant piping 100 in the compression unit 103 by the discharge side of a compressor 102, and heat exchange of the refrigerant (helium gas) of elevated-temperature high pressure pressurized with the compressor 102 is carried out to the high pressure gas of ordinary temperature.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, in an above-mentioned example, as shown in drawing 6 , when the pressure of low-tension side path 100B declines to near about 7kg/cm2, the refrigerant compressed with the compressor 102 of the compression unit 103 is bypassed from high-tension-side path 100A to low-tension side path 100B, and the flow rate supplied to a refrigerator 104 decreases rapidly. Thus, since the lower limit of the refrigerant flow rate which can be supplied to a refrigerator 104 from the compression unit 103 will be governed by the differential pressure regulating valve 110, the capacity which a compressor 102 originally has may be unable to be employed efficiently. Therefore, the compression unit 103 cannot secure broadly the flow rate of the refrigerant supplied to a refrigerator 104.
[0009] Moreover, when the set point of a differential pressure regulating valve 110 is 15kg/cm2 like the above-mentioned and the refrigerator 104 which makes 21kg/cm2 high-tension-side path 100A, and makes 5kg/cm2 low-tension side path 100B is connected to the compression unit 103 for example, a differential pressure regulating valve 110 will always open, and the high-pressure refrigerant of high-tension-side path 100A will be bypassed to low-tension side path 100B. For this reason, the highest cannot become 20kg/cm2, either, consequently high-tension-side path 100A of the compression unit 103 cannot demonstrate capacity of a refrigerator 104 to the maximum extent.
[0010] The purpose of this invention is made in consideration of an above-mentioned situation, and is to offer the very-low-temperature freezer which can secure from a compression unit broadly the flow rate of the refrigerant supplied to a refrigerator.

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PRIOR ART

[Description of the Prior Art] A very-low-temperature freezer is used for the cryopump which condenses or adsorbs a gas molecule at the panel cooled by very low temperature, and is made to generate high vaccum pressure, a panel is cooled to very low temperature (for example, 10-20K) as mentioned above, or it is used for cooling systems, such as a superconduction magnet and physical-properties test equipment, and makes a superconduction magnet and a sample cool to very low temperature (for example, 4K) generally.
[0003] The compression unit 103 and a refrigerator 104 equipped with the compressor 102 are connected for the connection piping 105A and 105B, and such a very-low-temperature freezer 101 is constituted, as shown in drawing 5 . A heat exchanger 106 is arranged in the refrigerant piping 100 in the compression unit 103 by the discharge side of a compressor 102, and heat exchange of the refrigerant (helium gas) of elevated-temperature high pressure pressurized with the compressor 102 is carried out to the high pressure gas of ordinary temperature. This high pressure gas is supplied to a refrigerator 104, adiabatic expansion is carried out, and low-temperature edge 104A of a refrigerator 104 is cooled by very low temperature.
[0004]

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EFFECT OF THE INVENTION

[Effect of the Invention] As mentioned above, the flow rate of the refrigerant supplied to a refrigerator from a compression unit since it was constituted so that it might open when it is connected by the bypass path whose high-tension-side path [of a compressor unit] and low-tension side path was equipped with the pressure regulating valve according to the very-low-temperature freezer concerning this invention and, as for the above-mentioned pressure regulating valve, the pressure of a low-tension side path turns into below a predetermined pressure, and a refrigerant might be bypassed to the low-tension side path from a high-tension-side path is broadly securable.

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MEANS

[Means for Solving the Problem] In the very-low-temperature freezer which has the compression unit equipped with the compressor which invention according to claim 1 compresses a refrigerant, and is pressurized, and the refrigerator which realizes very low temperature with the pressurization refrigerant from this compression unit The high-tension-side path and low-tension side path of the above-mentioned compressor unit are connected by the bypass path equipped with the pressure regulating valve. The above-mentioned pressure regulating valve It is characterized by having opened, when the pressure of a low-tension side path became below the predetermined pressure A, and being constituted so that a refrigerant may be bypassed from the above-mentioned high-tension-side path to the above-mentioned low-tension side path.
[0012] Invention according to claim 2 is set to invention according to claim 1. For the high-tension-side path of the above-mentioned compression unit

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the refrigerant circuit Fig. showing the gestalt of operation of the first of the very-low-temperature freezer concerning this invention.
[Drawing 2] In the very-low-temperature freezer of drawing 1 , it is the graph which shows the pressure within the low-tension side path of a compression unit, and relation with the refrigerant flow rate supplied to a refrigerator from a compression unit.
[Drawing 3] It is the refrigerant circuit Fig. showing the gestalt of operation of the second of the very-low-temperature freezer concerning this invention.
[Drawing 4] It is the refrigerant circuit Fig. showing the gestalt of operation of the third of the very-low-temperature freezer concerning this invention.
[Drawing 5] It is the refrigerant circuit Fig. showing the conventional very-low-temperature freezer.
[Drawing 6] In the very-low-temperature freezer of drawing 5 , it is the graph which shows the pressure within the low-tension side path of a compression unit, and relation with the refrigerant flow rate supplied to a refrigerator from a compression unit.
[Description of Notations]
10 Very-Low-Temperature Freezer
11 Compressor
12 Compression Unit
13 Refrigerator
15 Refrigerant Piping
15A High-tension-side path
15B Low-tension side path
23 Maine Pressure Regulating Valve (Pressure Regulating Valve)
24 Maine Bypass Piping (Bypass Path)
30 Very-Low-Temperature Freezer
31 Pressure Sensor
32 Solenoid Valve (Closing Motion Valve)
33 SubBypass Piping (SubBypass Path)
34 Compression Unit
40 Very-Low-Temperature Freezer
41 Sub Pressure Regulating Valve
42 SubBypass Piping (SubBypass Path)
43 Compression Unit

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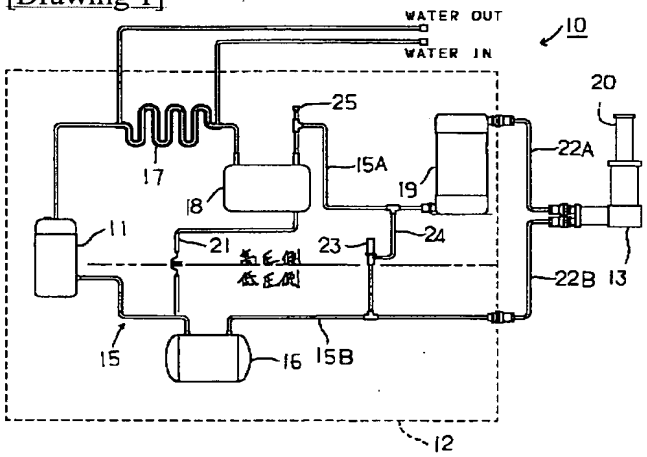
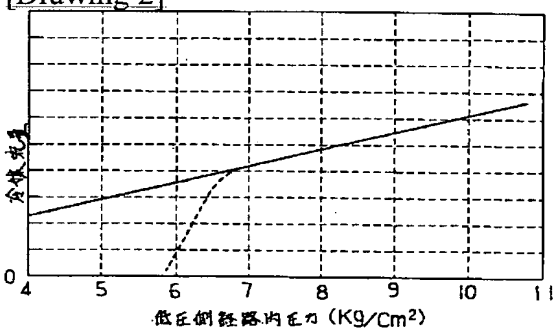
DRAWINGS

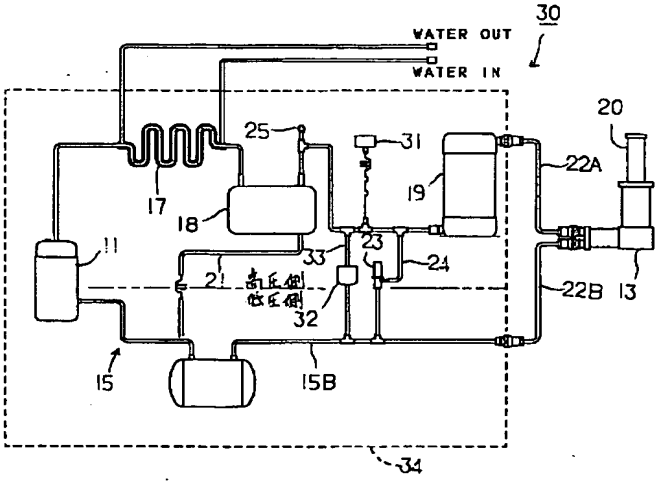
[Drawing 1]



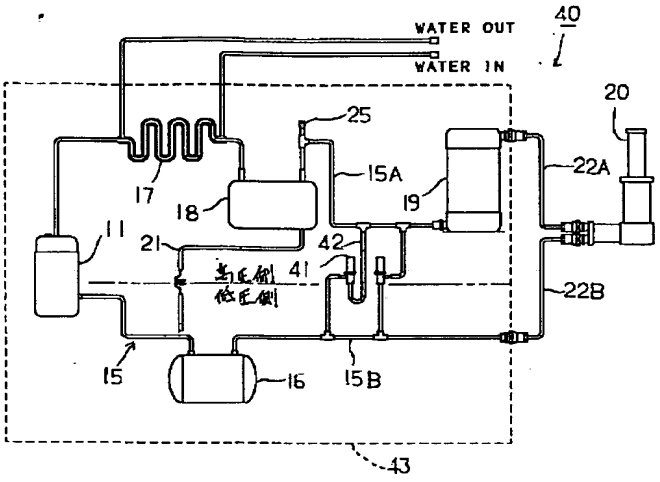
[Drawing 2]



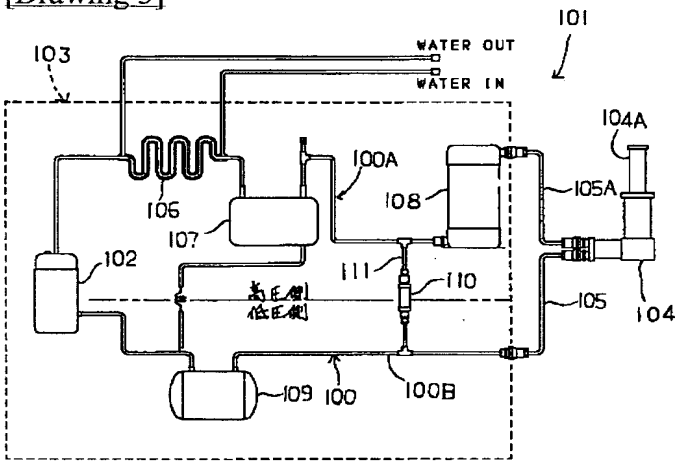
[Drawing 3]



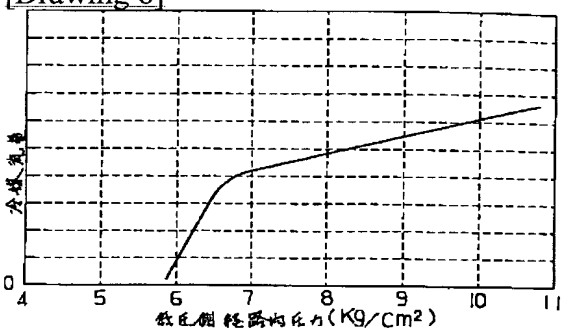
[Drawing 4]



[Drawing 5]



[Drawing 6]



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